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Risk Study – Phase III

Status Report for

Colorado River District

Board of Directors

April 16, 2019

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Phase III Scope of work

- Current and Future Conditions Modeling in Both CRSS and StateMod
  - Current = 2018 Demand schedule from UCRC (CRSS); StateMod's baseline
  - Future Demands = Define first for StateMod, then synchronize with CRSS
- Investigate StateMod behavior with respect to admin and adjudication dates:
  - Uncertainty about "pre" vs "post" compact water volumes
  - Within and across west-slope basins
  - Using several different administration dates
- Evaluate Different Curtailment Scenarios in StateMod:
  - Volumes by basin
  - Volumes by west slope / TBD pro-rata (split by basin or as a whole)
- Evaluate a 500KAF Upper Basin Water Bank (ala the DCP)
  - At Powell with 50kaf and 100kaf annual contributions.
  - To protect against Compact Deficit.

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How Much Consumptive Use is Senior to Key Dates in Development of Colorado Water?

Modeled Administration dates:

- (12/31/1899) turn of the Twentieth Century (as a "bookend")
- (11/24/1922) the signing of the Colorado River Compact
- (6/25/1929) the signing of the Boulder Canyon Project Act
- (7/31/1935) one day prior to the Colorado-Big Thompson Project Senior administration date
- (7/30/1957) the day after the Fryingpan-Arkansas Project administration date

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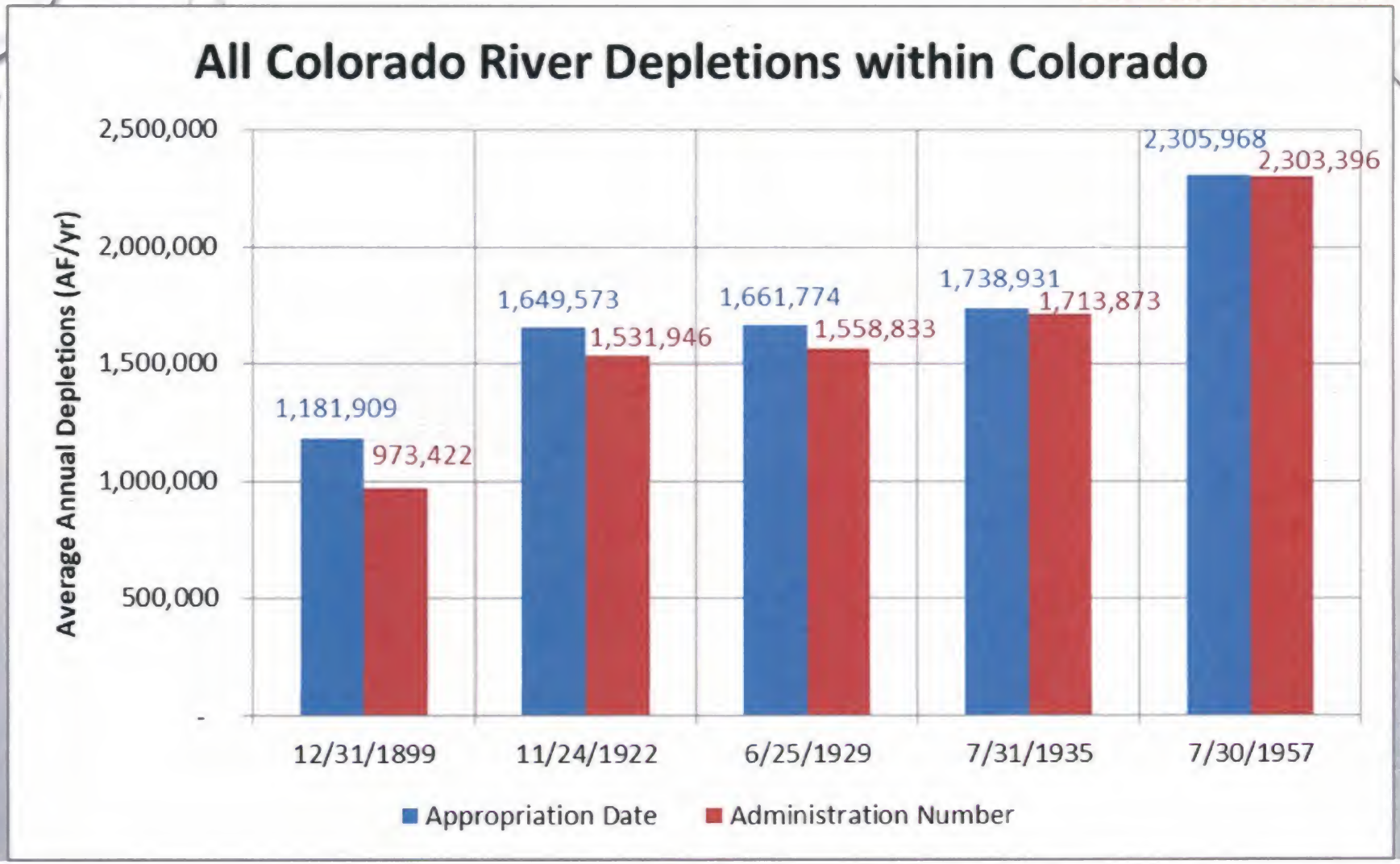

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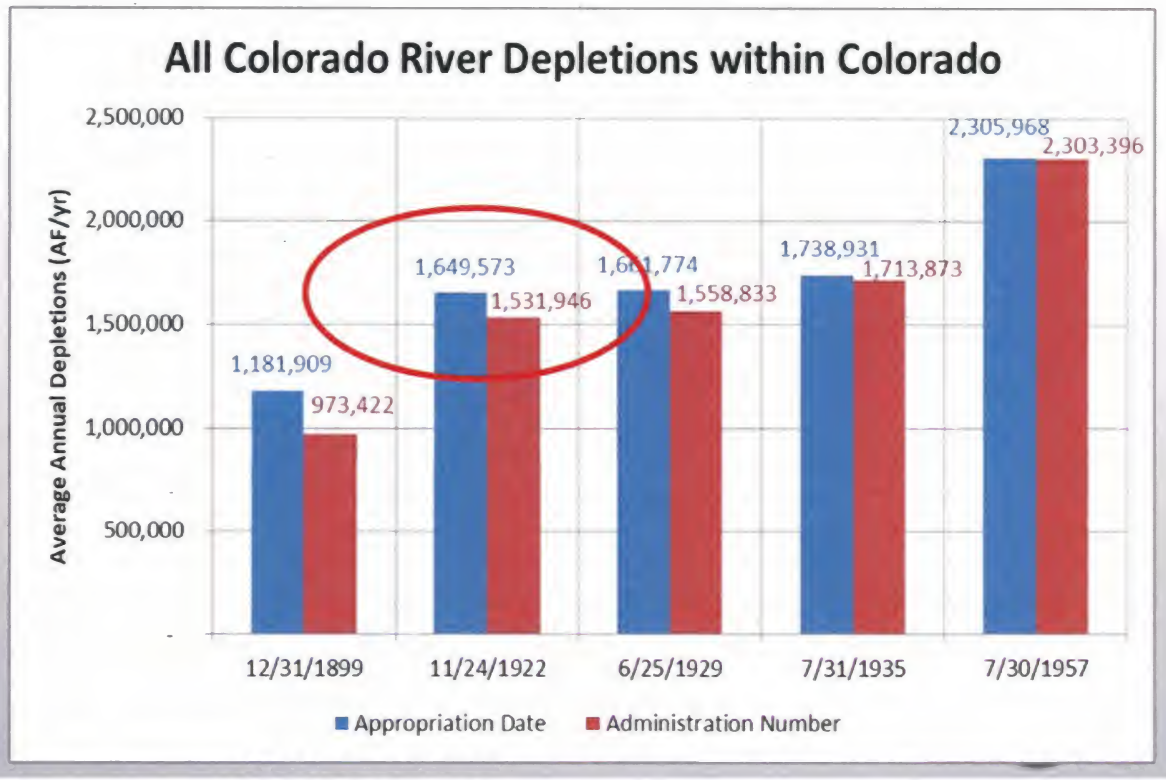
- Note the simulated pre-compact consumptive use numbers
- higher than we expected (conventional wisdom based on Historical usage suggests ~1.1-1.2 MAF)



Why?

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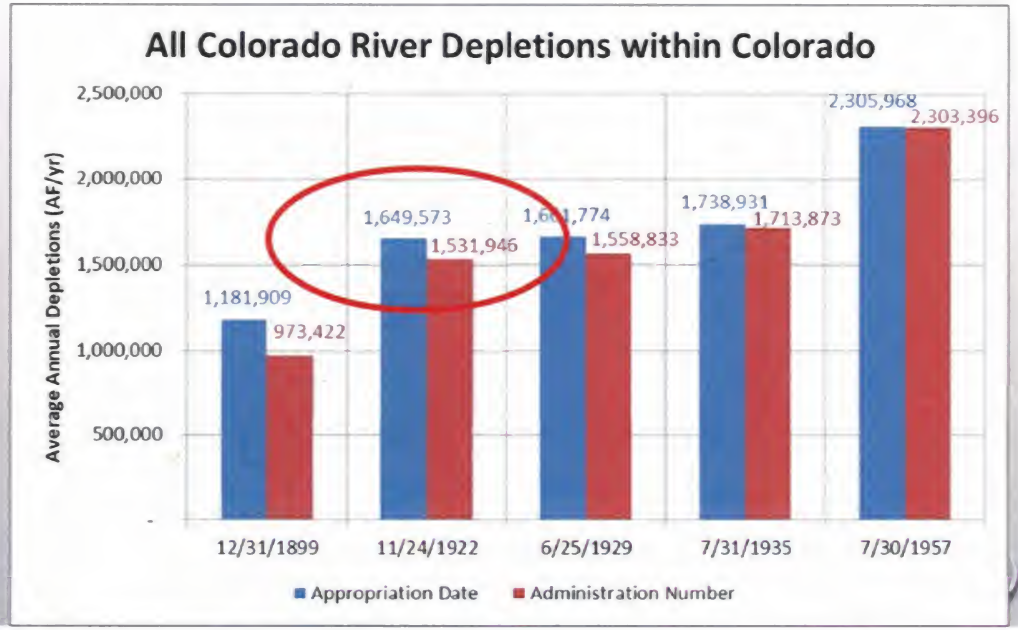
- Increased irrigation efficiency if only using pre-1922 rights
  - Typically there is water available for both SR and JR rights, so modeled efficiency is lower (this is also reflected in actual usage data)
- Better methodologies for determining Crop CU over time
  - Modified B-C including High-Alt adjustments lead to higher CU than previously computed



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Digging into the details of the Statemod model

- Baseline individual basin StateMod vs CRSS
- Baseline linked StateMod vs Baseline individual basin StateMod
- Baseline linked StateMod vs Future Use

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Individual Basin StateMod / CRSS Comparison

- StateMod and CRSS results from 1988-2005 (current period of overlap when using the "Stress Test" hydrology)

CRSS

CRSS-BL (current)	Annual Depletions (AF/yr)		
	Minimum	Average	Maximum
Yampa	169,151	193,879	209,249
White	22,884	36,624	48,310
Upper Colorado & Front Range	684,794	1,227,709	1,294,957
Gunnison	269,198	501,108	532,688
San Juan & Dolores	224,687	410,644	438,421
StateWide	**1,370,713**	**2,369,965**	**2,523,625**

StateMod

StateMod Individual (current)	Annual Depletions (AF/yr)		
	Minimum	Average	Maximum
Yampa	173,547	196,982	215,193
White	48,550	62,060	69,030
Upper Colorado & Front Range	1,117,487	1,220,386	1,345,192
Gunnison	502,591	575,267	624,538
San Juan & Dolores	335,365	500,717	556,627
StateWide	**2,258,518**	**2,555,413**	**2,743,484**

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Linked StateMod vs Individual Basin StateMod Results

- 1988-2005
- Average Depletions Are Similar (~ 1% Diff)
- Upper Colorado model from CRWAS, not 2015 update

Individual Basin Models

Individual Model Basin	Average CU (AF/yr)	Average Evap (AF/yr)	Average Loss (AF/yr)	Average Depletions (AF/yr)
Yampa	170,538	12,870	13,573	196,982
White	49,758	3,086	9,217	62,060
Colorado	1,117,645	48,414	54,327	1,220,386
Gunnison	487,856	37,715	49,697	575,267
San Juan	424,764	33,600	42,353	500,717
Total Individual	**2,250,560**	**135,685**	**169,167**	**2,555,413**

Linked Model

Linked Model Basin	Average CU (AF/yr)	Average Evap (AF/yr)	Average Loss (AF/yr)	Average Depletions (AF/yr)
Yampa	169,354	11,383	13,147	193,884
White	49,750	1,767	9,216	60,733
Colorado	1,108,453	45,157	52,867	1,206,476
Gunnison	489,354	34,674	49,241	573,269
San Juan	417,240	29,747	42,776	489,763
Total Linked	**2,234,151**	**122,728**	**167,246**	**2,524,125**

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StateMod Future Uses

- Future Uses identified through conversations with BRT reps on the Technical Working Group
- Shortages are apparent both to new uses as well as some junior existing uses (Especially on the Colorado mainstem)
- Equivalent increases used for other Upper Basin states in CRSS (equivalent to approximately 2040 in the 2017 UCRC Demand Schedule)

StateMod Linked Model	Future Use Depletions (AF/yr)		
	Average Yield of New Depletions	Average Increase in Basin Depletions	Input Demand
Yampa	29,506	29,485	30,104
White	61,839	61,787	65,000
Upper Colorado & Front Range	86,077	82,425	120,450
Gunnison	31,053	31,100	37,900
Southwest	81,104	82,355	130,499
StateWide	**289,578**	**287,153**	**383,953**

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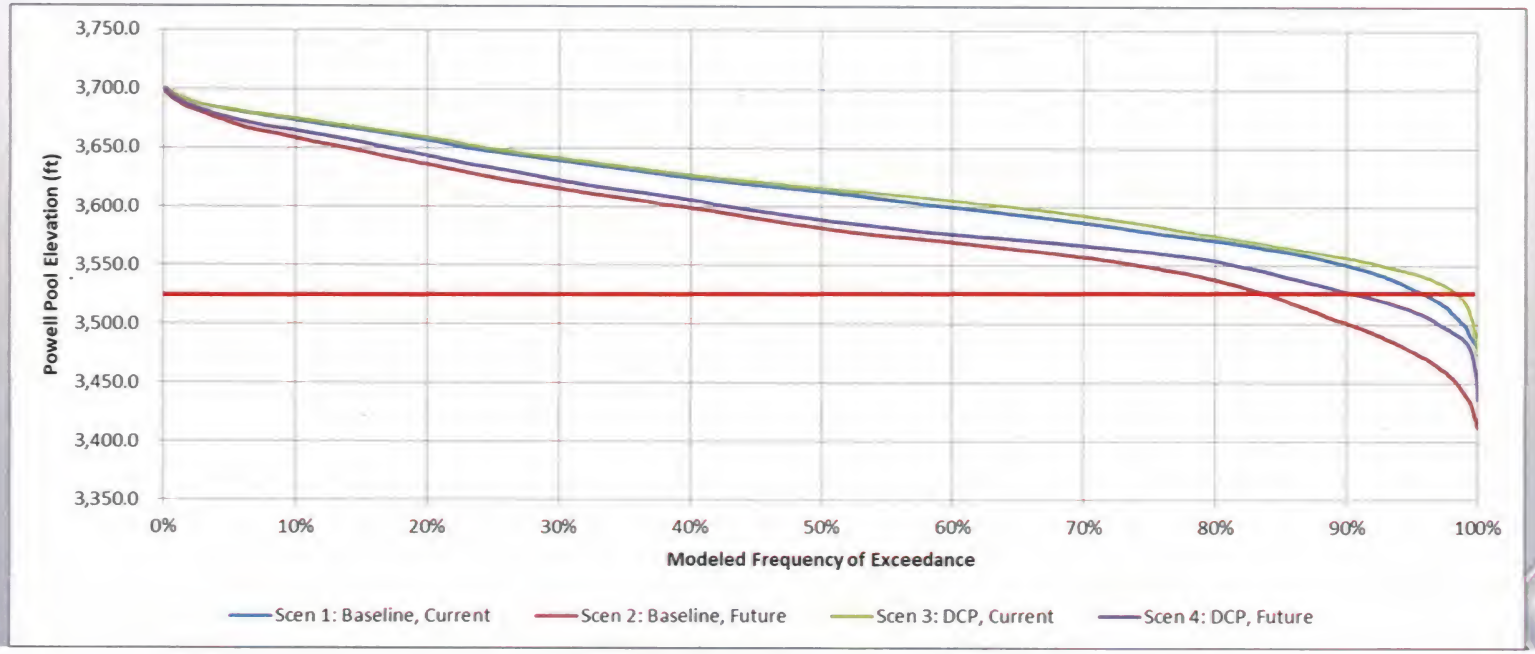
Preliminary Results

- Simulating Lake Powell conditions with linked StateMod/CRSS model
- Baseline = 2019 / Current conditions demands
- Future = ~2040 (UT, WY, NM); New demands for StateMod (+384kaf)
- Stress Test (1988-2015) Hydrology



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What's Next?

- Continue To Look at Pre-Compact CU Estimates
- Simulate Different Call / Demand Management Scenarios in StateMod
- Simulate Stress Test in CRSS With Current StateMod Depletions
- Incorporate Future Depletions Into CRSS
- CRSS Simulations with Water Bank
- Paleohydrology Simulations
- Re-Evaluate Lake Powell Risk Profiles

END